

NON-PUBLIC?: N
ACCESSION #: 9108140164
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Waterford Steam Electric Station Unit 3 PAGE: 1 OF 05

DOCKET NUMBER: 05000382

TITLE: Reactor Trip Due to Faulty Relay
EVENT DATE: 05/28/91 LER #: 91-011-01 REPORT DATE: 08/08/91

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 034

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: J.G. Hoffpauir, Maintenance TELEPHONE: (504) 464-3138
Superintendent

COMPONENT FAILURE DESCRIPTION:
CAUSE: X SYSTEM: EL COMPONENT: 86 MANUFACTURER: S440
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

At 0809 hours on May 28, 1991, the Waterford Steam Electric Station Unit 3 main turbine was manually tripped due to a loss of governor control. After the turbine trip, an automatic reactor trip occurred when the electrical bus powering two reactor coolant pumps failed to transfer from the unit auxiliary transformers to the startup transformers upon loss of the main turbine. During the subsequent transient, a Main Steam Isolation Signal actuation occurred. This event is being reported as unplanned actuations of engineered safety features.

The root cause of this event was a faulty relay that prevented the electrical bus transfer. A contributing cause to this event was an inadequate procedure that, during troubleshooting of the main turbine digital electro hydraulic system, caused the loss of governor control. Another contributing cause to this event was a ground in a maintenance cabinet that caused main turbine load fluctuations. The faulty relay was

replaced, the procedure revised and the cause of the ground removed. Plant protective features functioned as designed; therefore, this event did not threaten the health or safety of the general public or plant personnel.

END OF ABSTRACT

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At 0809 hours on May 28, 1991, Waterford Steam Electric Station Unit 3 was operating at 34% reactor power when the main turbine (EIS Identifier TA) was manually tripped due to a loss of governor (EIS Identifier TA-65) control. After the turbine trip, an automatic low flow reactor trip occurred when the electrical bus (EIS Identifier EA-BU) powering reactor coolant pumps (EIS Identifier AB-P) 1B and 2B failed to transfer from the deenergized unit auxiliary transformers (EIS Identifier EA-XFMR) to the energized startup transformers.

At 0240 on May 28, Megawatt (MW) load swings were experienced on the main turbine when shifting main turbine governor control from single valve to sequential valve control. In single valve control, the four governor valves (EIS Identifier SB-FCV) are controlled as one unit, while in sequential valve control, the four governor valves are controlled individually. When the main turbine digital electro hydraulic control (DEH) system (EIS Identifier JJ) was in turbine automatic single valve control, MW load was steady.

When notified of the load swings, Instrumentation and Control (I&C) technicians checked various DEH system readings at the DEH system maintenance cabinet (EIS Identifier JJ-CAB). This maintenance cabinet has several switches (EIS Identifier JJ-HS) that are manipulated to feed different system readings to a common display. Normal readings were observed.

Since the load swings occurred during the switch from single to sequential governor valve control, the technicians suspected that a digital-to-analog converter XHC card (EIS Identifier JJ-CNV) was faulty and received permission to conduct diagnostic testing. The digital-to-analog converter XHC card is a printed-circuit card that provides control signals to a card that distributes signals to a governor valve when the main turbine is in sequential valve control.

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The procedure used for the diagnostic testing was Maintenance Instrumentation (MI) 005-162, DEH Control Subsystem Diagnostic

Maintenance and Calibration. Although the procedure states that diagnostic testing may be done when the main turbine is in turbine manual mode, the applicable section of the procedure had never been used while the main turbine was operating. The I&C technicians also checked the DEH system vendor technical manual to verify that diagnostic testing could be performed at power. The vendor technical manual lists digital-to-analog converter XHC cards as online servicable, but does not specify a requirement to isolate these cards prior to testing.

At approximately 0800 hours, section 8.4 of MI-005-162 was commenced. Due to an improperly-sequenced procedural step, the output of the digital-to-analog converter XHC card was not isolated prior to running the test. The testing of the digital-to-analog converter XHC card caused load swings on the main turbine that could not be controlled from the control room. Consequently, the main turbine was manually tripped.

When the turbine was tripped, the electrical bus supplying the B1 and B2 reactor coolant pumps should have automatically transferred to the energized startup transformers. The 3B1 electrical bus did not transfer, however, due to a faulty relay (EHS Identifier 86), causing an automatic low flow reactor trip when reactor coolant pumps 1B and 2B deenergized. Subsequent to the reactor trip, a Main Steam Isolation Signal (MSIS) (EHS Identifier - JE) occurred due to low steam generator (SG) (EHS Identifier - SG) pressure. The combination of a normal RCS post trip transient and low decay heat (a reactor startup and power ascension was in progress) caused a larger than expected drop in SG pressure.

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The root cause of this event was a faulty relay that prevented the automatic transfer of the 3B1 electrical bus to the startup transformer. The faulty relay, a Struthers Dunn 600 series, has been replaced. The relay failed due to a coil failure caused by degradation of the plastic sleeve surrounding the core. The degradation of the sleeve was discovered when the relay was disassembled and inspected.

This mode of failure is unique; other relay failures have been due to high contact resistance. When required plant conditions are met, the three other relays for the startup transformers will be inspected. Other similar relays are being identified in order to evaluate potential generic concerns.

Subsequent troubleshooting revealed the cause of the original turbine load swing, which occurred when switching from single to sequential valve control, to be a ground caused by a test lead coaxial cable. The coaxial cable had been attached to the cabinet after the DEH system was installed

in 1981 and had been left connected for convenience. The cable was used to attach a calibrated meter to the maintenance cabinet to obtain calibrated readings since the cabinet meter is not a calibrated instrument.

The ground only affected main turbine operation when the maintenance panel selected governor valve demand switch was selected to the turbine controller position and turbine control was switched from single to sequential valve control; an unlikely occurrence since this switch is rarely in the turbine controller position. The selected governor valve demand switch had apparently been left selected to the turbine controller position after testing conducted during the recent refueling outage.

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Two contributing causes have been identified. One contributing cause is the ground caused by the coaxial cable that adversely affects turbine operation when specific conditions were met. This cable has been removed. The other contributing cause is the inadequate procedure that had the step to isolate the digital-to-analog converter XHC card after the step to commence diagnostic testing. When the steps were done in the sequence the procedure specified, test signals caused turbine load shifts. The technicians realized the procedural deficiency soon after the main turbine was tripped. The procedure has been revised. The plant protective features functioned as designed; therefore, this event did not threaten the health or safety of the general public or plant personnel.

SIMILAR EVENTS

A reactor trip due to an overheated resistor in a DEH system circuit board was reported in LER 85-035. A reactor trip due to a failed XHC card was reported in LER 88-016.

PLANT CONTACT

J.G. Hoffpauir, Maintenance Superintendent, 504-464-3138

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Ref: 10CFR50.73(a)(2)(iv)

W3B5-91-0215
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QA

August 8, 1991

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Submittal of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report Number LER-91-011-01 for Waterford Steam Electric Station Unit 3. This Licensee Event Report supplement is submitted to report an additional Engineered Safety Feature Actuation which occurred during the event and provide updated causal and corrective action related information. This report is submitted pursuant to 10CFR50.73(a)(2)(iv).

Very truly yours,

D.F. Packer
General Manager - Plant Operations

DFP/DDW/rk
Attachment

cc: Messrs. R.D. Martin
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NRC Resident Inspectors Office

*** END OF DOCUMENT ***
